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ABSTRACT

The Lansing Community College (LCC) Math Lab offers two arithmetic and two developmental algebra courses and provides a placement and proficiency testing program for the mathematics department and for other selected departments in the college. Students who participate in Math Lab courses: (1) take a placement test and/or have a placement interview with a lab instructor to settle on which course to take; (2) complete the course handout exercises, review them with a lab instructor, and receive first practice test; (3) begin work in textbook using study guides or assignment tables; (4) attend weekly lecture if enrolled in one; (5) come to lab instructor for help on materials or problems as needed; (6) review for and take self-administered practice test; (7) when ready, request the post-test and take it in the Math Lab testing area; (8) move on to next test if post-test score is at least 75%, or complete review assignments if score is lower; and (9) receive final grade. Information about all test results is entered into a computer-managed instruction (CMI) system. The CMI facilitates formative evaluations of course design and curricula, and the tracking of student success rates by student characteristics and placement test scores, and of course evaluations. Fourteen graphs displaying evaluation data are presented. The paper concludes with some brief comments on the networks and resources that seem to be available to professionals in developmental mathematics education. (EJV)

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The LCC Developmental Math Lab -- An Evaluative Review

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November 1, 1987

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THE LCC DEVELOPMENTAL MATH LAB -- AN EVALUATIVE REVIEW

Lansing Community College Jack W. Rotman

Presented at the annual American Mathematical Association of Two Year Colleges (AMATYC) at Kansas City, November 1, 1987.

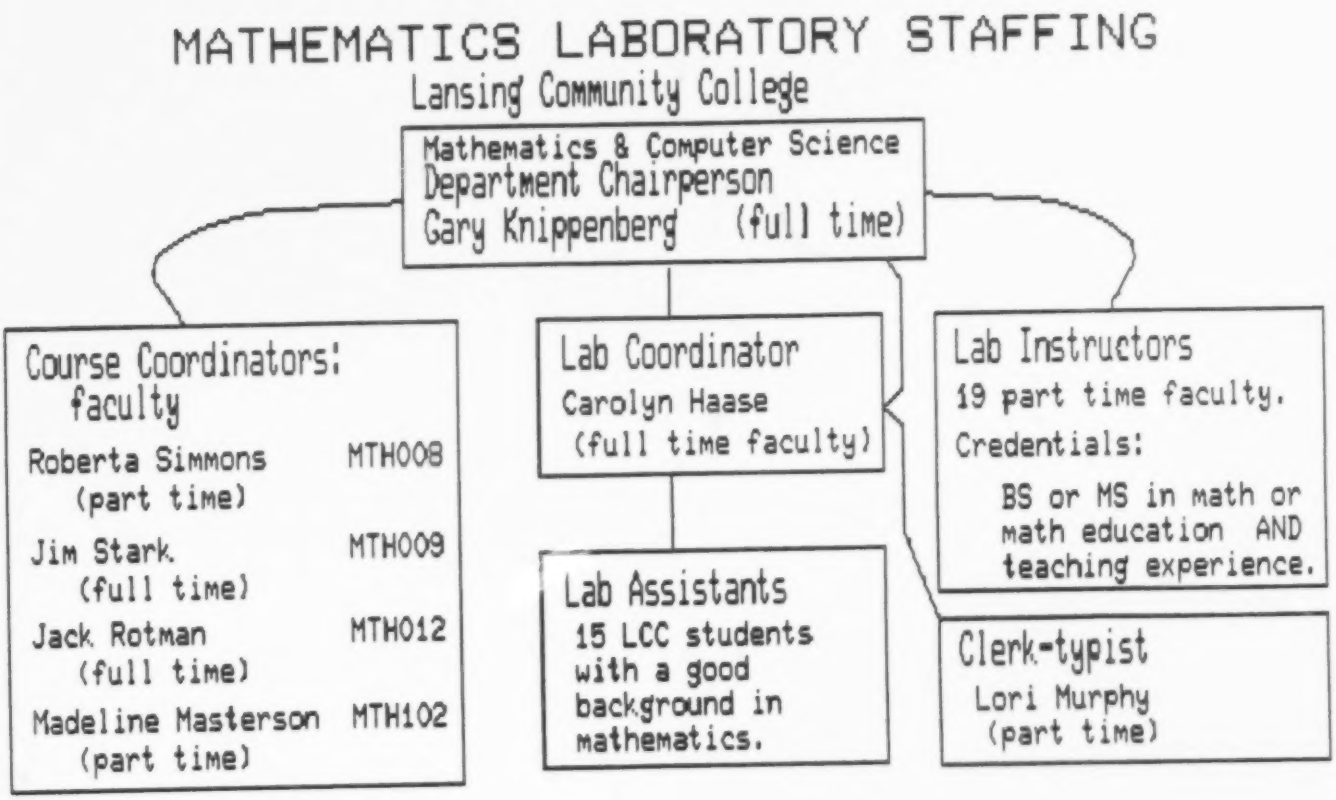
In this presentation, I have three main goals. First of all, to briefly describe for you the LCC Math Lab in terms of its courses, services, staffing, and student procedures. Secondly, to illustrate the types of program evaluations that we have used in our situation. Thirdly, to point out known networks for developmental math educators and what I feel are needs for further development. In addition, it is important for us to have the opportunity to share experiences and learn from each other, and I hope that we can spend some time doing just that.

Let us first describe what the LCC Math Lab consists of. Our largest single activity is offering four courses. We have two arithmetic courses: MTH 008 is Basic Arithmetic, while MTH 009 is Pre-Algebra. There are also two developmental algebra courses: MTH 012 is Beginning Algebra, and MTH 102 is Intermediate Algebra. At this time, we are developing a fifth course in geometry. The current courses are 5 credits on a term system, while the new geometry course will be 2 credits. Our annual enrollments for four terms range from about 400 in MTH 008 to about 1000 in the other three courses. The Math Lab is open 70 hours per week, with a capacity of about 65 students per hour. (Totally separate from the Math Lab, the Math department offers two or three standard classroom sections of the two algebra courses each term.)

Our program is somewhat unique in that we offer "Extension Center Labs" in a number of local communities, including two industrial sites. In these Labs, the same materials are used as in the main LCC Math Lab, but the staffing, capacity, and hours are much reduced. This last year we operated 7 Extension Centers, and enrolled about 680 students in the four courses.

The second major activity of the LCC Math Lab is our Placement and Proficiency Testing program. We have a series of Placement Tests which are used for all students entering math courses throughout our department, from our developmental courses to the standard college algebra and calculus sequence. A given student is administered the Placement Test best suited for their particular course; for example, students wishing to take MTH 008 or MTH 009 take our "Arithmetic Placement Test", while those wishing to take MTH 012 or MTH 102 are given our "Algebra Placement Test". Each Test is offered in two forms to allow students to retake the Test if needed. In addition, the Placement Testing service is used by other math, math related, or science classes in other departments of the College. We also offer a Proficiency Testing service, which enables a student to determine if they can waive enrolling for a course. The Proficiency Tests are used primarily by selected programs in the College, such as Health Careers, but this service is also being used by some courses as an entrance requirement; the Natural Science sequence is the main user of the Proficiency tests to enter a course. Last year, we gave about 4700 Placement tests and about 430 Proficiency tests. This testing service is growing each year as more programs and courses at the College make the decision to have their students tested as a general procedure.

Staffing in the LCC Math Lab is unique in a number of ways. The chart below shows our overall staff relationships.



In this chart, the lines between boxes imply some hierarchy of positions; in practice, the Math Lab functions with a lot of interdependence and communication between staff. Also, we have a "Planning Committee" which consists of the 5 Coordinators plus the Department Chairperson; this Planning Committee copes with various decision making needs as well as long term planning. Of great concern to all of us is the dependence on part time faculty, as the Math Lab depends upon a continuity of staff (especially since the College has become dependent upon us to be open for about 47 weeks each year); professional development is another area in which we have some concerns, especially as related to the part time faculty.

To help us better understand how the Math Lab works, let us examine the basic procedure that students use to succeed in our courses. The next page shows an outline of student procedures for our courses; note that the same basic procedure is followed in all four courses.

' AN OUTLINE OF STUDENT PROCEDURES in the LCC Math Lab

1. Take Placement Test(s), if necessary.

2. Placement Interview with a Lab Instructor, to settle on which course and to receive course materials, including a recommended Test Schedule for completing the course testing.

3. Complete the Course Handout Exercises, and review these Exercises with a Lab Instructor; this is our orientation. Receive first Practice Test Lab Instructor makes sure student is well oriented to Math Lab.

4. Begin work in text book using the Study Guides or assignment table.

5. Attend weekly lecture, if enrolled in one. (1 hour class, 1 day/week)

6. Come to Lab Instructor for help on materials or problems, as needed. (Use the video tapes as needed, in the algebra courses.)

7. After finishing assignments for each Test, review for the Test following directions provided. (There are 10 Post Tests and a Final.)

8. Take Practice Test (Test is self-administered). If the score on the Practice Test is less than 80%, student MUST see a Lab Instructor.

9. When ready, request the Post Test and take it in Math Lab Testing Area.

   If the score on the Post Test is less than 75%, student MUST see a Lab Instructor to review the Test and receive a "HOLD assignment". This is a review assignment which must be done satisfactorily before attempting another form of the Post Test. (4 forms available)

   If the score on the Post Test is at least 75%, the student begins work on the assignments for the next Test. Student has the option of repeating the Post Test once with a different form to "Grade Raise".

10. When the Final is passed, the Course Coordinator assigns a grade to the folder. At the end of the term, any uncompleted folders are also assigned grades by the Course Coordinator; these grades could be 0.0, I, or W.

    If course is completed early (before the end of the term), student may "Early Start" the next Math Lab course.

    If student is 2 or more weeks behind the recommended Test Schedule in the first half of the term, a letter may be sent to the student by the Course Coordinator.

Once we understand the general way that the Math Lab functions, we can begin to examine the evaluation methods. Any evaluation depends upon tools that can be used to provide information or analysis. The LCC Math Lab uses a variety of tools; some of these are listed on the next two pages.

CMI SYSTEM (Computer Managed Instruction)

We enter information about all tests (including placement tests and post tests) into the CMI system; other useful information on each student is also recorded. The Math Lab has 5 IBM terminals connected to the College's mainframe computer, which also allows us to interact with the registration system and data base. Without the CMI system, we would be unable to serve such a large number students in the kind of learning system used in the Math Lab. As part of the CMI system, we receive various reports used by instructors and coordinators to manage the Math Lab; in addition, much of the information is extracted from the CMI system and transferred to the College's VAX 11/780 (a Digital Equip Corp machine), where much of the evaluation using data is performed.

SERVICE CODES TO INDICATE EACH STUDENTS PRIOR MATH AT LCC

We classify each student's LCC math history into these groups: (code)

- No prior math at LCC; (5)
- Passed the prerequisite course at LCC (and whether this was done in a Lab or in a standard classroom); (2 or 1)
- Had an Incomplete grade in the prerequisite at the end of the prior term; (7)
- Repeating this course from a prior term; (4)
- All others. (9)

The vast majority of our students are in the first two categories (passed the prerequisite or no prior LCC math), with 15% to 20% of the students repeating the course.

SPSSx (Statistical Package for the Social Sciences)

The information extracted from the CMI system is then analyzed using SPSSx procedures; mostly, all we have used within SPSS is crosstabulation and averages by categories. Much of this work involves categorizing student performance by their service code.

S2020 (Spreadsheet from Access Technology)

The information gleaned from SPSS and the CMI reports is normally then entered into a spreadsheet. We have several advantages to this: first, the electronic spreadsheet is a more reliable storage medium than hard copy files (not to mention less bulky); secondly, the data can be averaged or totalled over a period of time with little difficulty; also, S2020 allows us to produce graphic forms of the data, which makes interpreting the data easier.

COURSE EVALUATION FORMS

When each student takes the 7th test in their course, we ask them to fill out a Course Evaluation form. This form differs from most conventional evaluation forms in that the items on it were written to provide us with useful information to evaluate and improve our courses (as opposed to providing a tool for administrative evaluation of faculty). The items on the form deal with whether they like the text or not, what they thought of our tests, how we could improve our materials, general comments about the Lab policies or staff, and etc. Although some of this information can be quantified, it is essentially a source of qualitative evaluation data (which is very helpful to us in the Math Lab, but not easily presented in a situation like we are in today).

MATH LAB GOALS

When any program is evaluated, a reference point is needed: what are the goals that the program is attempting to accomplish? In addition, one needs to determine ways to measure to what extent various goals ar being met. The Math Lab Coordinators have developed a list of 18 goals. Here is a selected list from our formalized Lab Goals:

Provide a sequence of courses which will allow all students to improve or review their developmental math skills.

To the maximum degree possible, ensure that students master the stated objectives of their course.

Prepare students for their next math course.

Assist students in improving study habits and test-taking skills

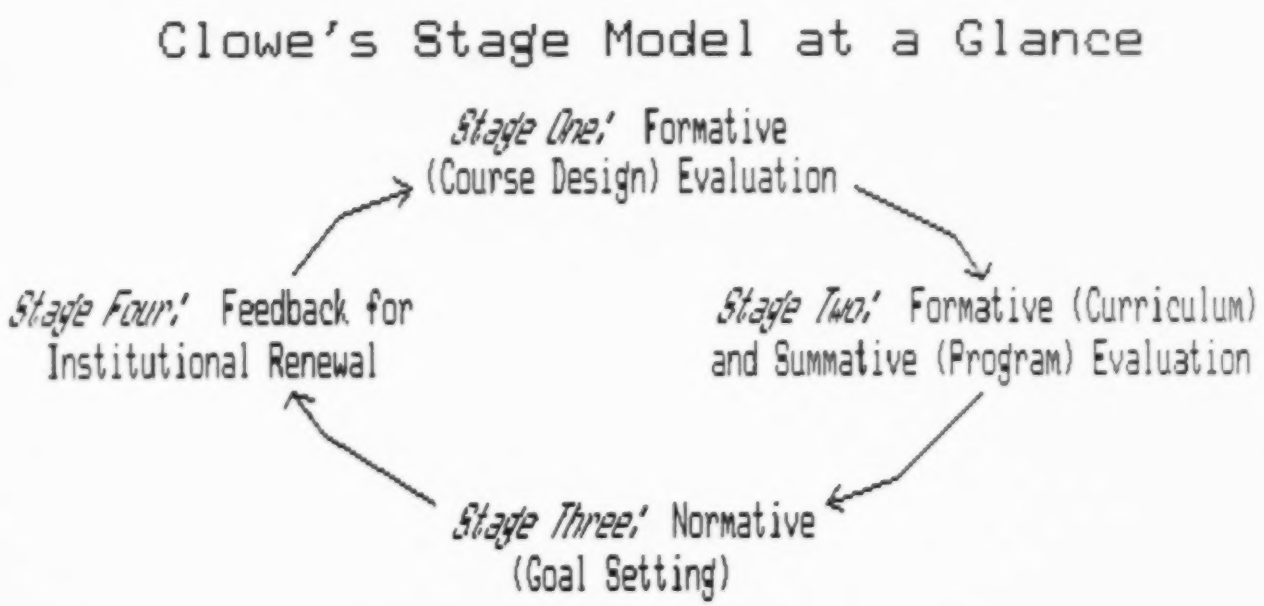
Develop positive attitudes toward math and the confidence to achieve mathematical goals.

Reduce math anxiety.

Develop the ability to learn independently in a structured system.

The cognitive goals, such as the first four listed here, are much easier to evaluate on a regular basis than the affective goals. Nonetheless, we attempt to evaluate all goals, or at least make inferences about them from other data.

An issue of importance is that of a model of evaluation; in our case, we have not formally addressed this issue for the LCC Math Lab. For our purposes today, the model below might be helpful.


Clowe's Stage Model at a Glance
Stage One: Formative (Course Design) Evaluation
Stage Two: Formative (Curriculum) and Summative (Program) Evaluation
Stage Three: Normative (Goal Setting)
Stage Four: Feedback for Institutional Renewal

(taken from Research in Developmental Education, Volume 4 Issue 2 1987)

In the context of this model, most of our evaluation has been in the firs two stages; the Math Lab has not closed the loop to make a complete cycle. Le us examine the kinds of evaluation that we have carried out.

The next seven pages show these graphs:

a) Annual Rate On Schedule, by Course (compared to the recommended Test Schedule).

b) Annual Rate of Success, by Course (rate of passing and Incomplete grades).

c) MTH 009 (Pre-Algebra) Rate of Success by Prior LCC Math.

d) MTH 012 (Beginning Algebra) Rate of Success by Prior LCC Math.

e) MTH 102 (Intermediate Algebra) Rate of Success by Prior LCC Math.

f) MTH 164 (College Algebra; a post-developmental level course) Rate of Success by Prior LCC Math.

g) MTH 009 Rate of 0.0 Grades by Arithmetic Placement Test Score.

h) MTH 012 Rate of 0.0 Grades by Algebra Placement Test Score.

i) MTH 102 Rate of 0.0 Grades by Algebra Placement Test Score.

j) MTH 164 Rate of 0.0 Grades by College Algebra Placement Test Score.

k) Course Evaluations: Percent Return by Course.

l) Course Evaluations: "Like Textbook" Rating by Course.

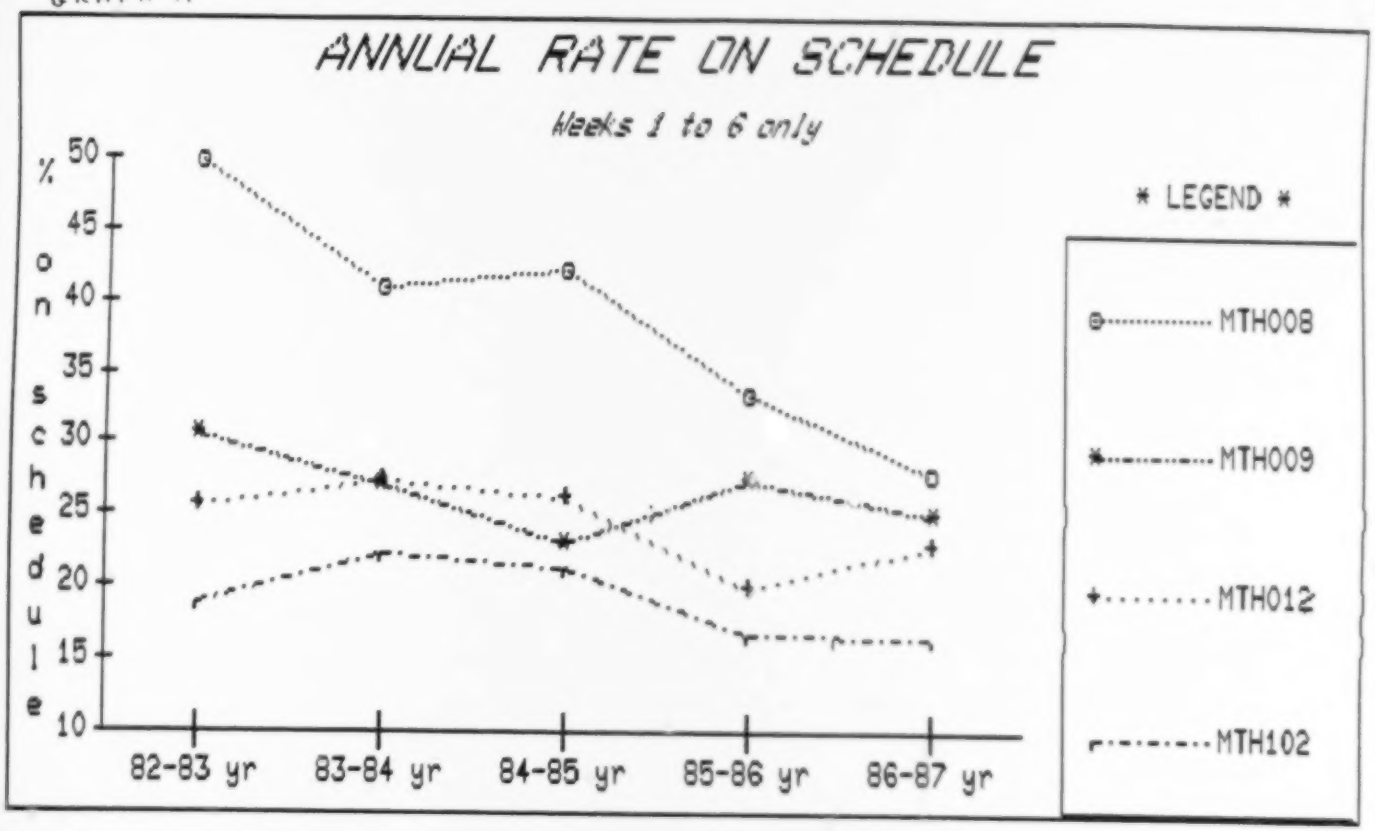
m) Course Evaluations: Positive Comments by Course.

n) MTH 164 Rate of Success by Ethnic and Sex Codes.

Graphs g) thru j) represent accumulated data over a 2 year period; the other graphs represent figures for annual periods in order to show any trend for change. Each graph is presented here without any conclusions drawn. It seems to me that a good program evaluation avoids making a large number of finite conclusions; instead, the program evaluation should attempt to synthesize a body of evaluative data into conclusions and ideas for changes.

The data represented in these tables comes from 3 different sources. The first two graphs come from reports as part of our Computer Managed Instruction system. The graphs (k, l and m) which deal with course evaluation data are taken from the manual summaries of each term's forms. All other graphs were generated on our VAX computer, using information passed over from the IBM computer (where almost all records are kept). As you examine the graphs, you will notice that the numbers of students involved are not indicated; by traditional standards, most numbers in each category are quite large (> 100). In the case of the data concerning placement tests, the numbers are lower for groups to the left of the "current cutoff score".

GRAPH A



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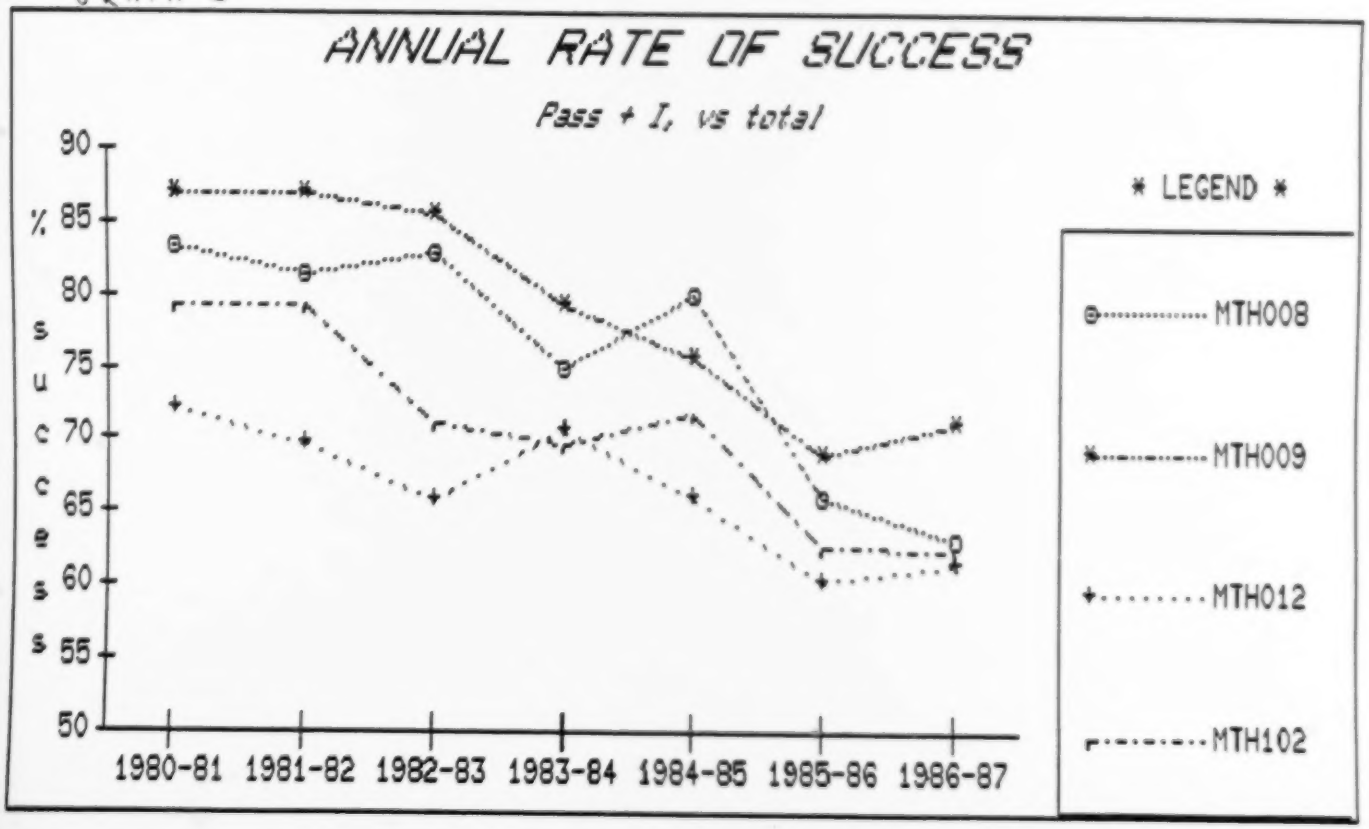

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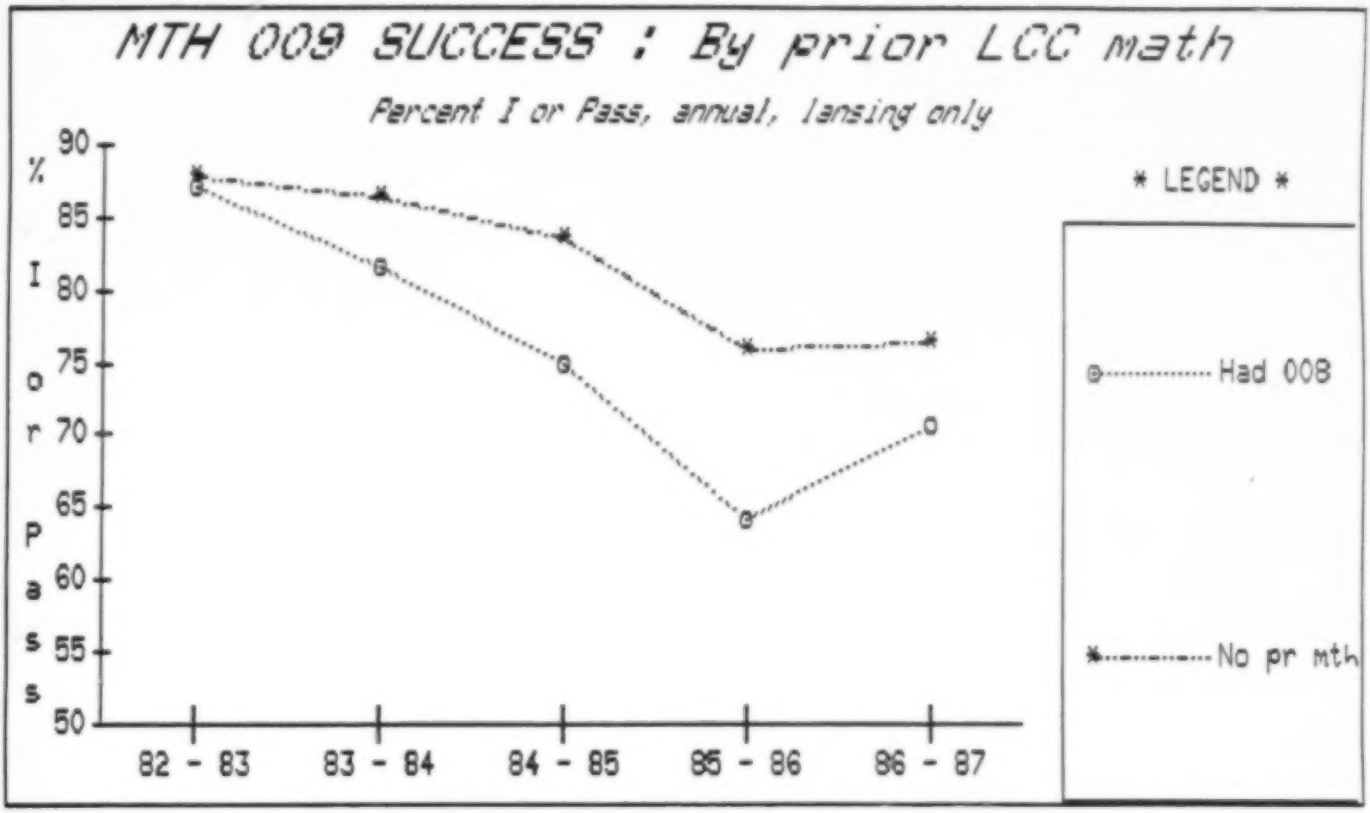

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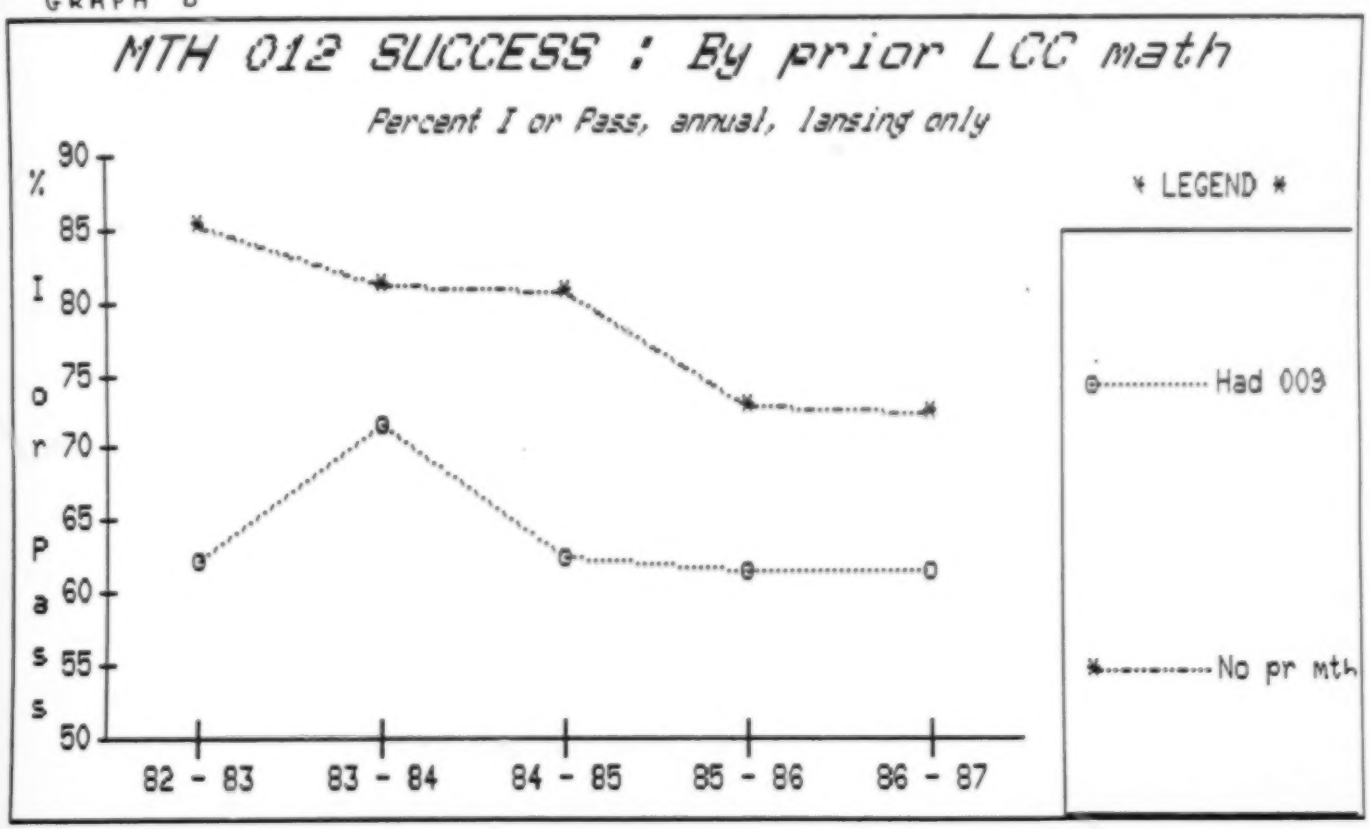
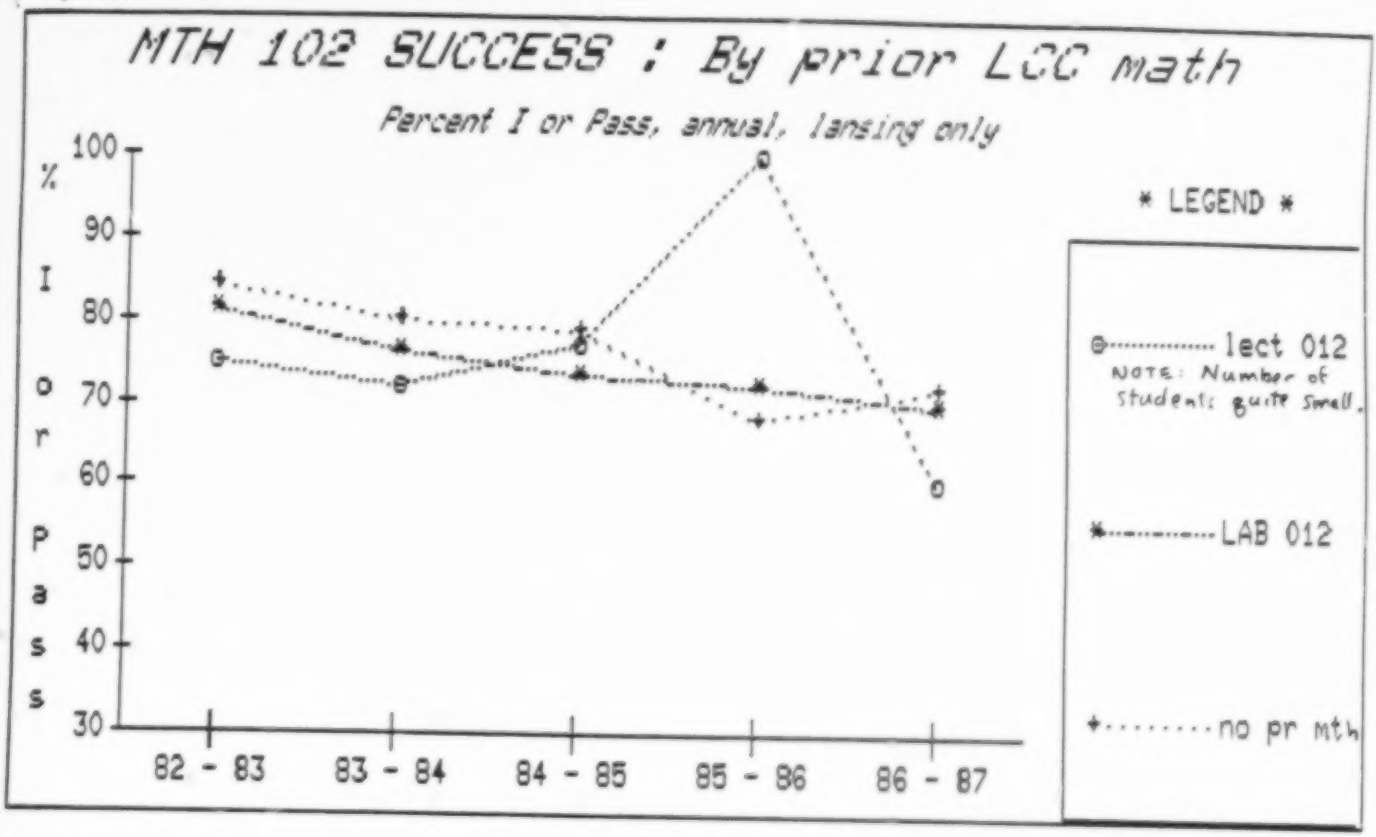
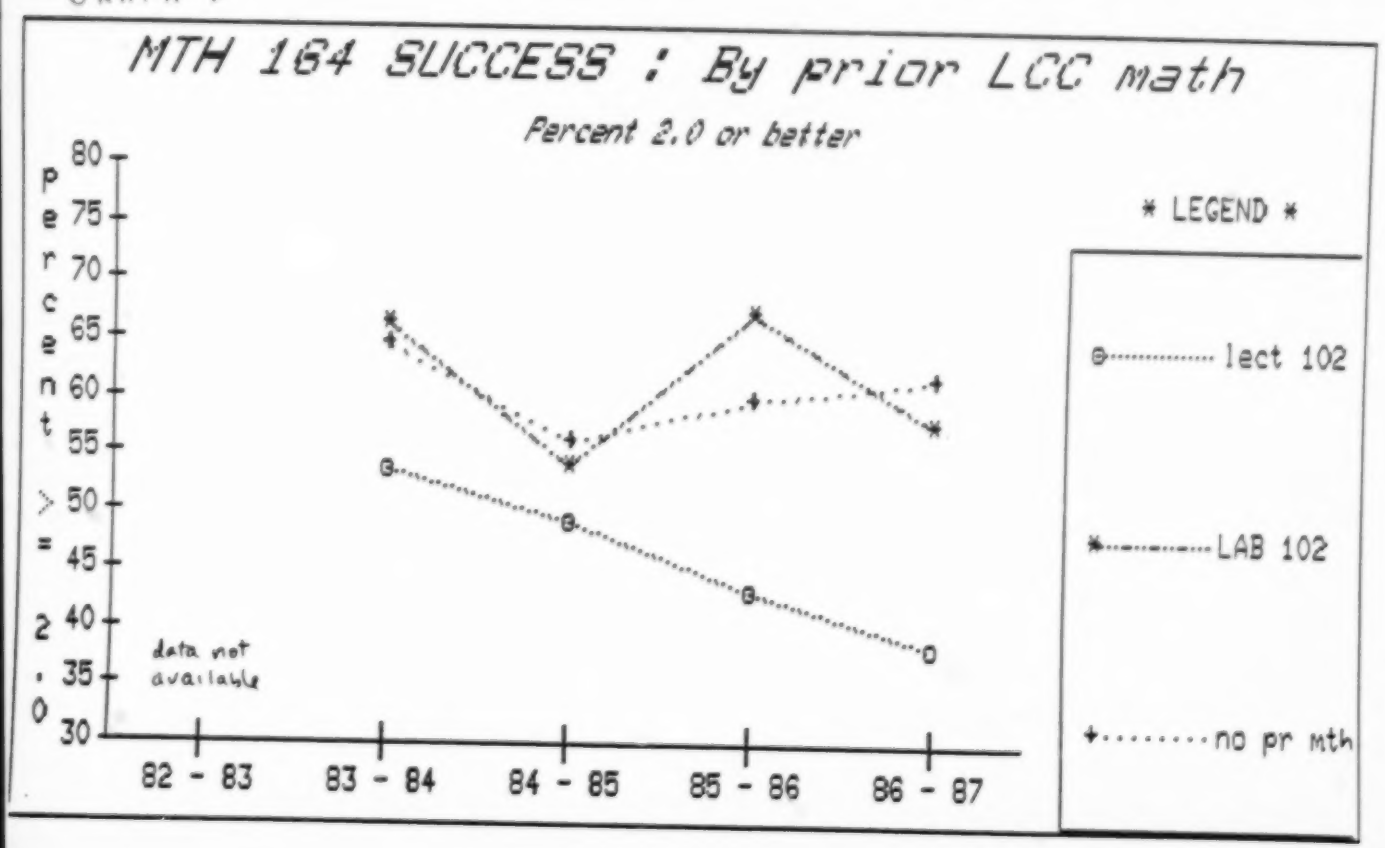


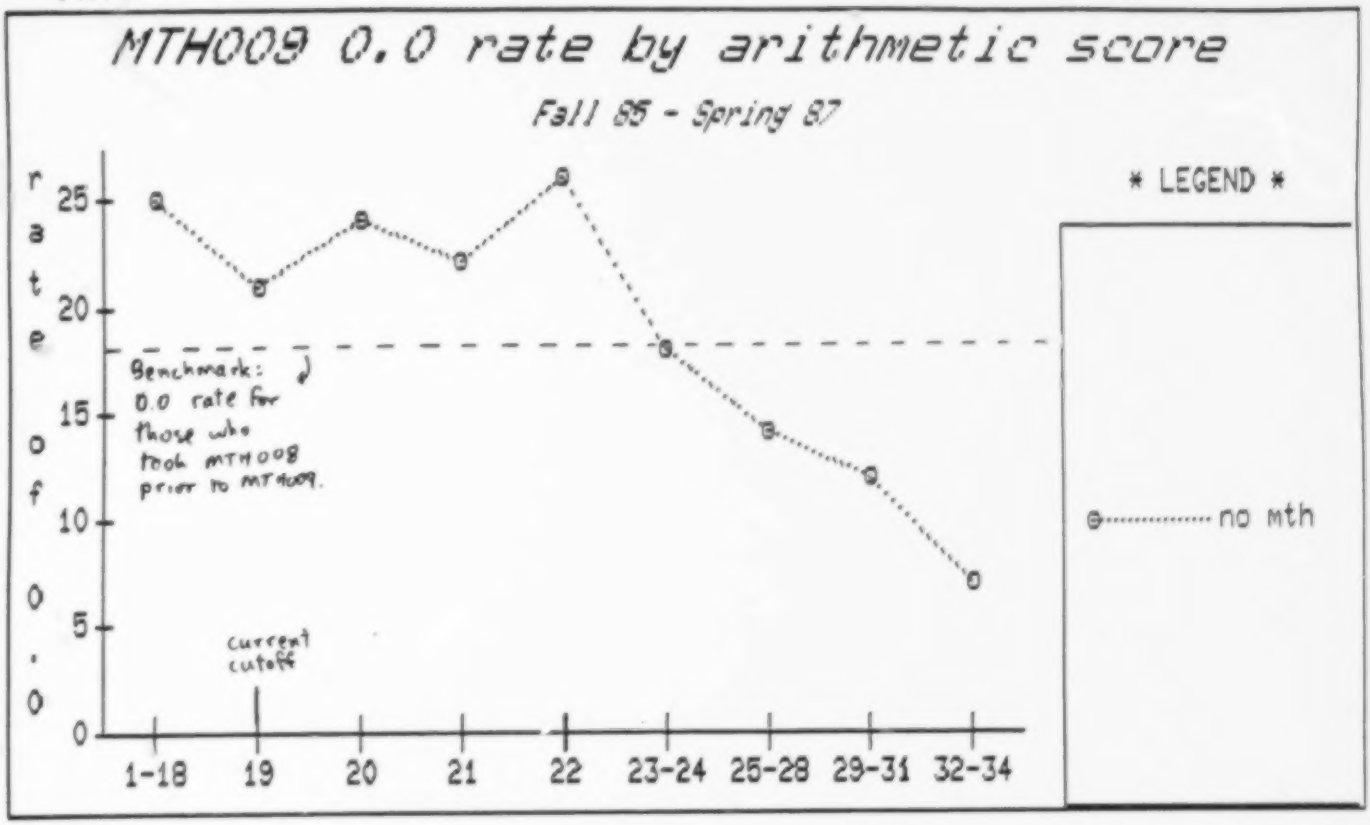
GRAPH E



GRAPH F



GRAPH G



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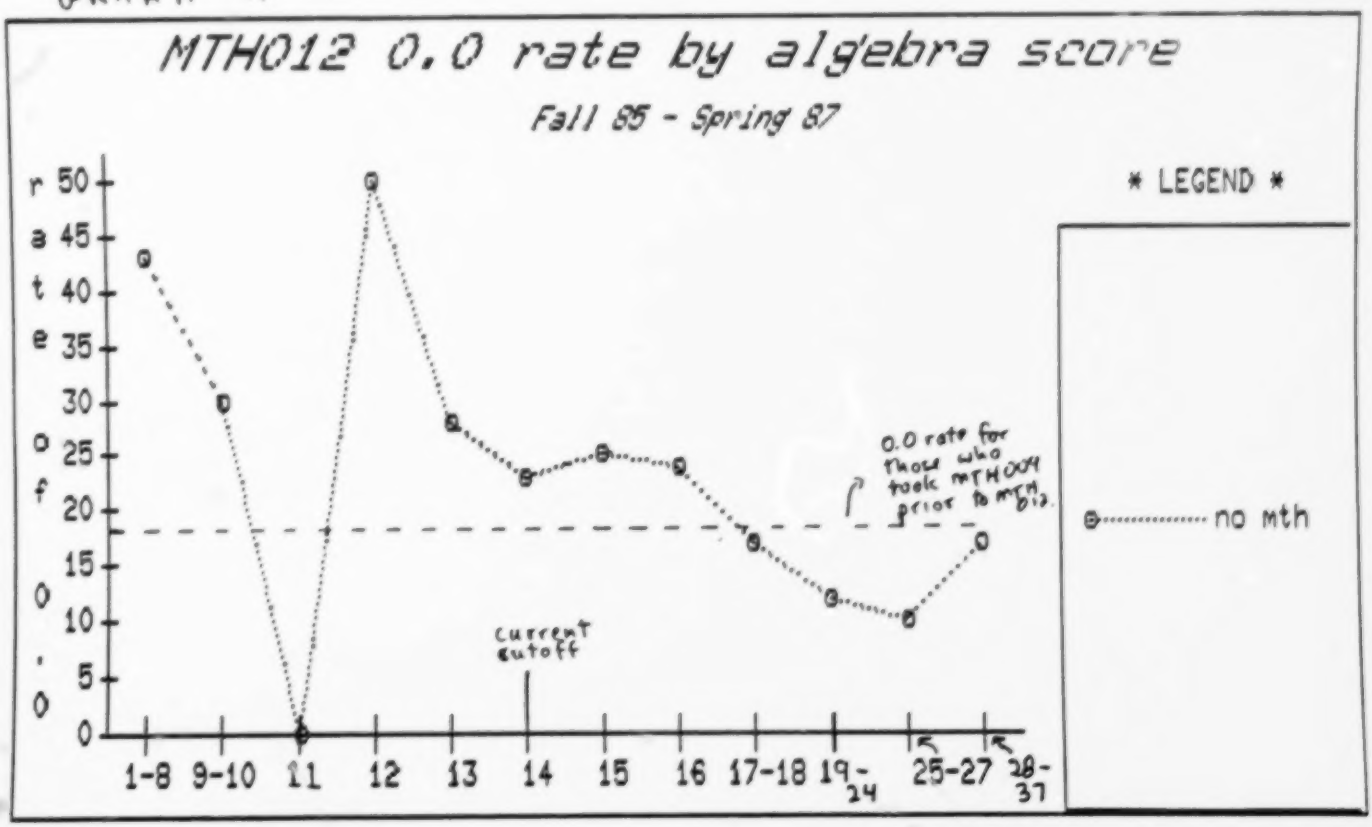
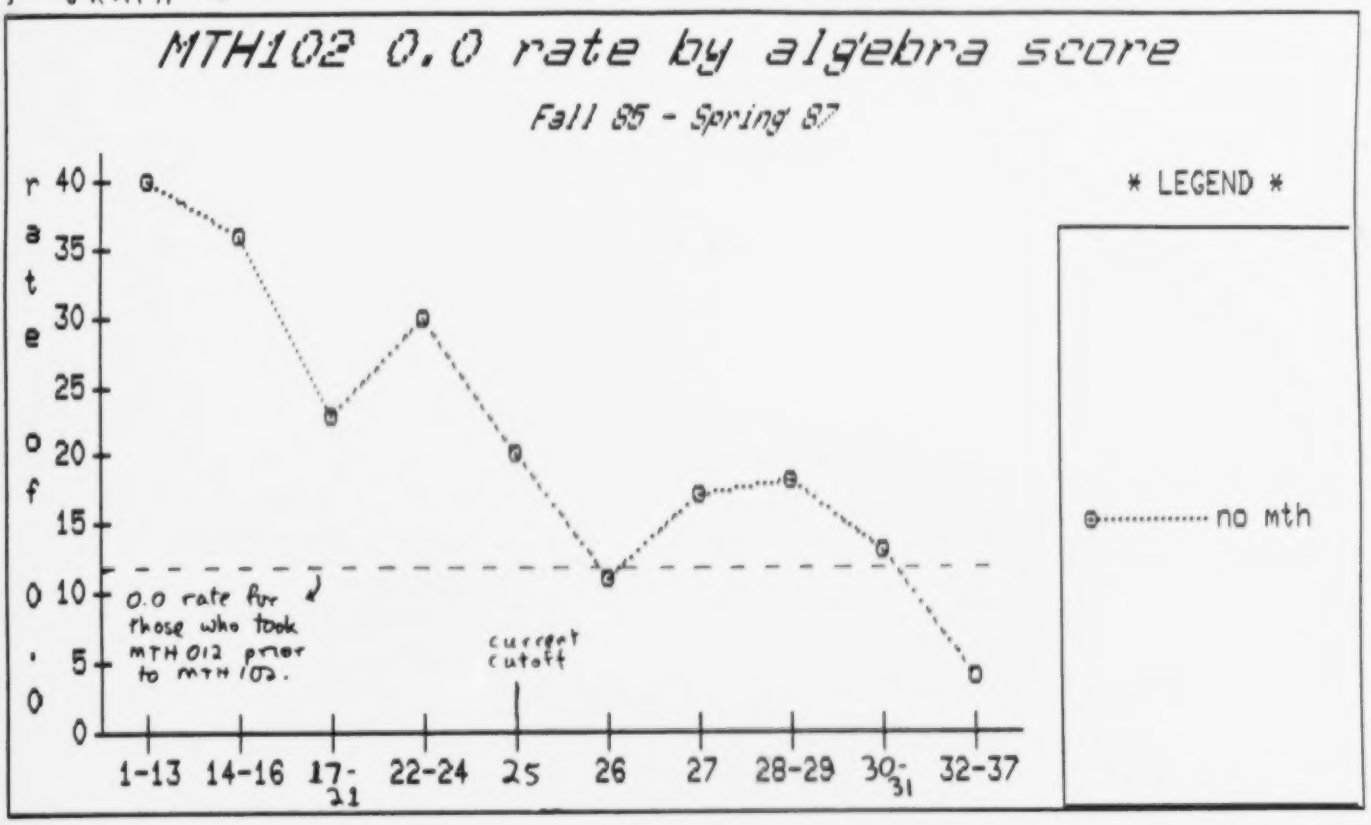
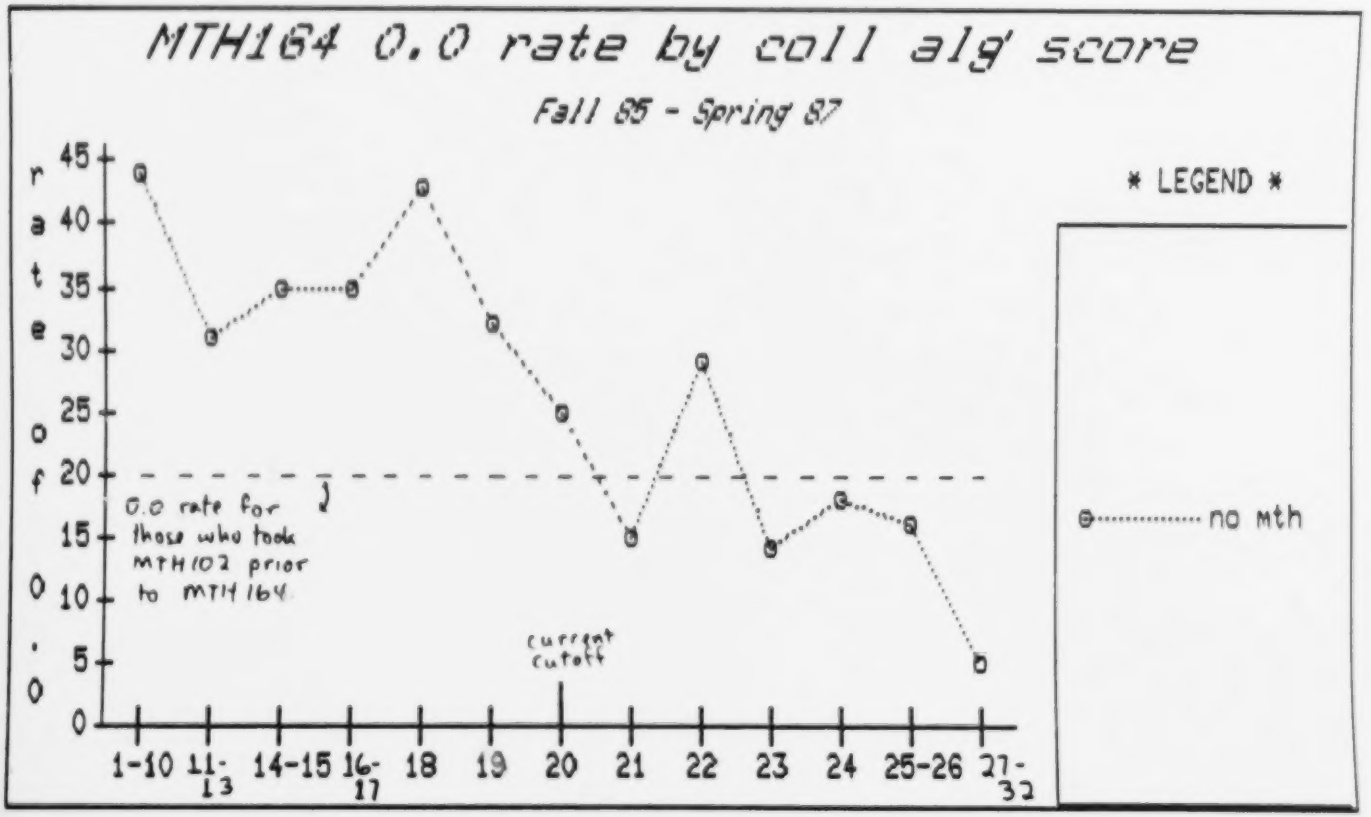


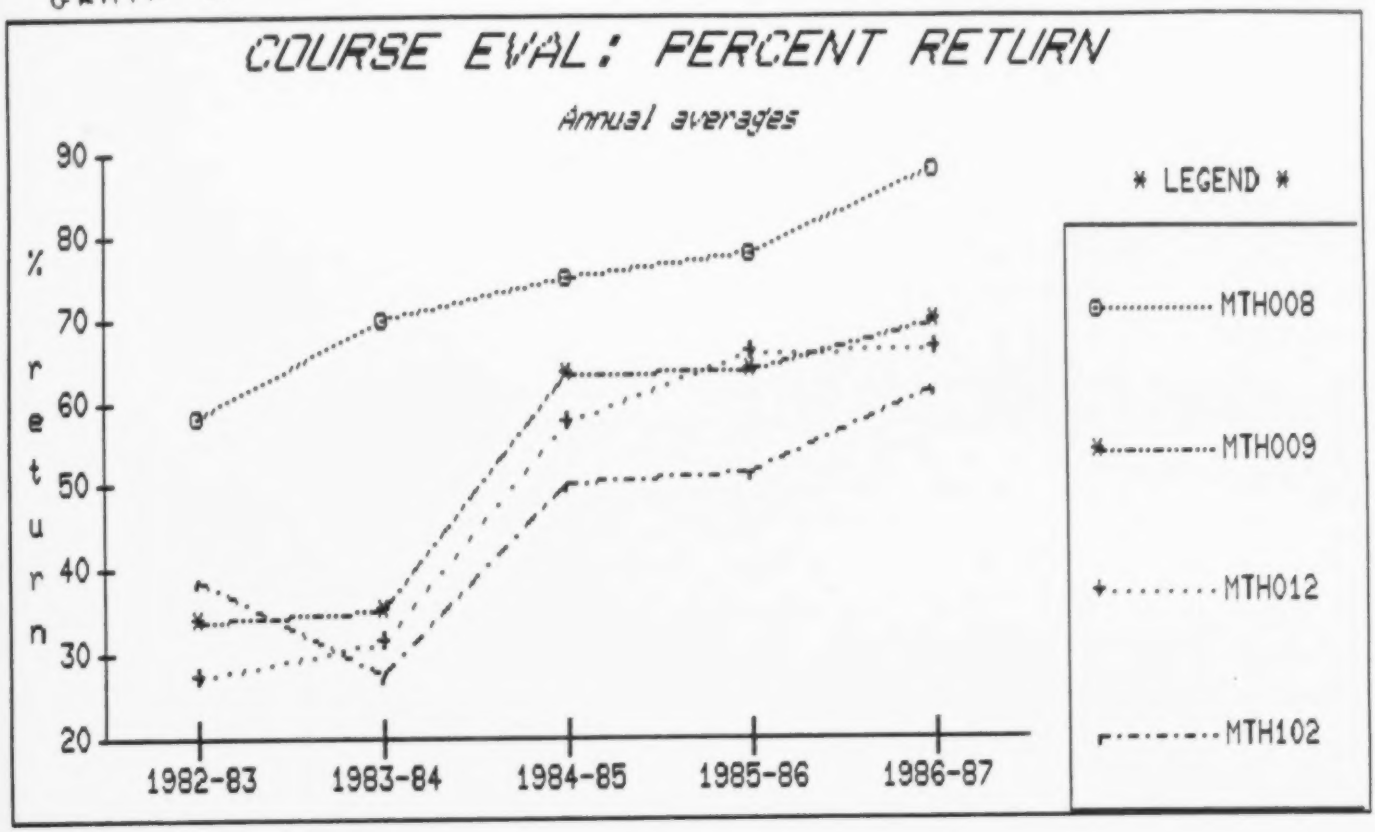
GRAPH I



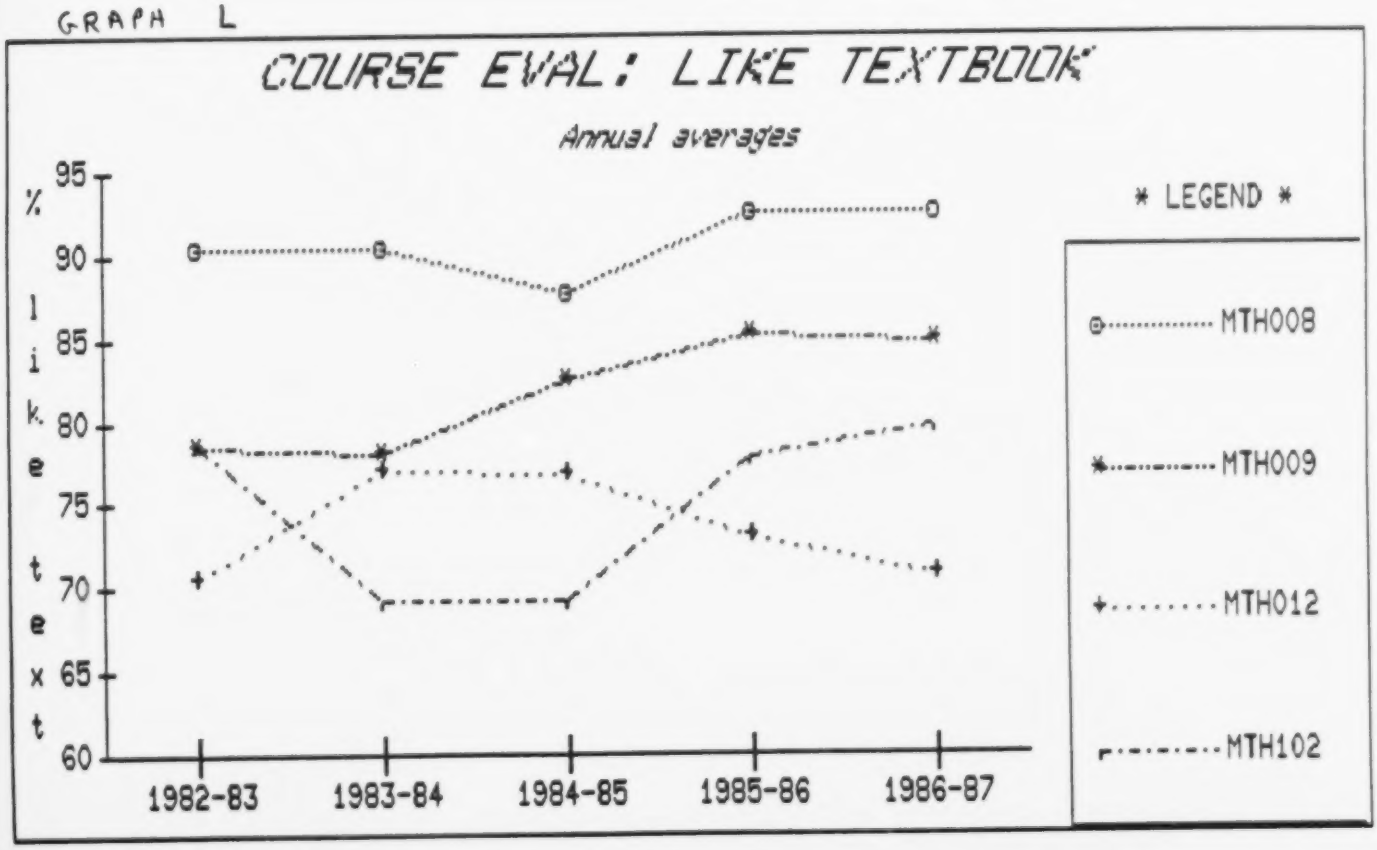
GRAPH J



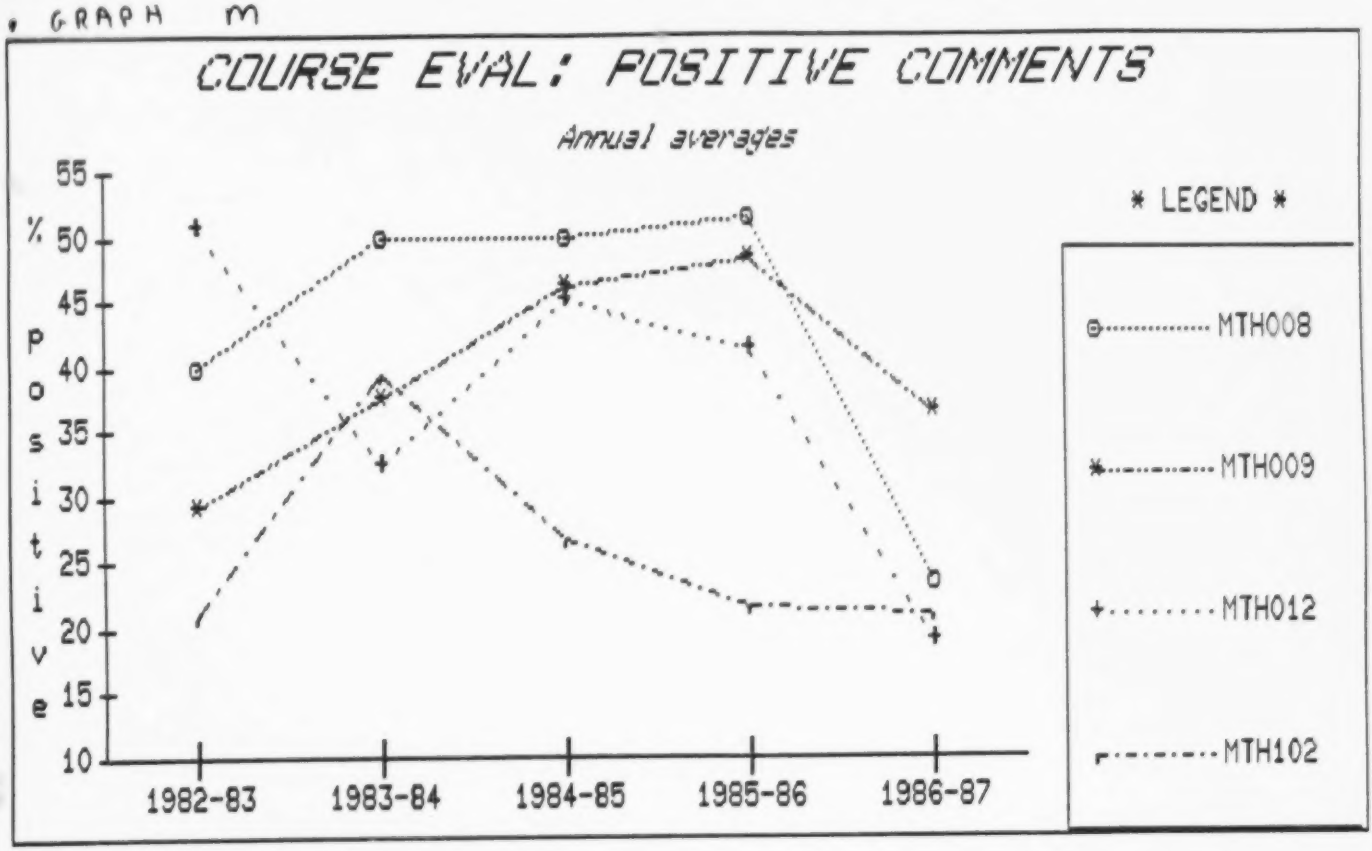
GRAPH K



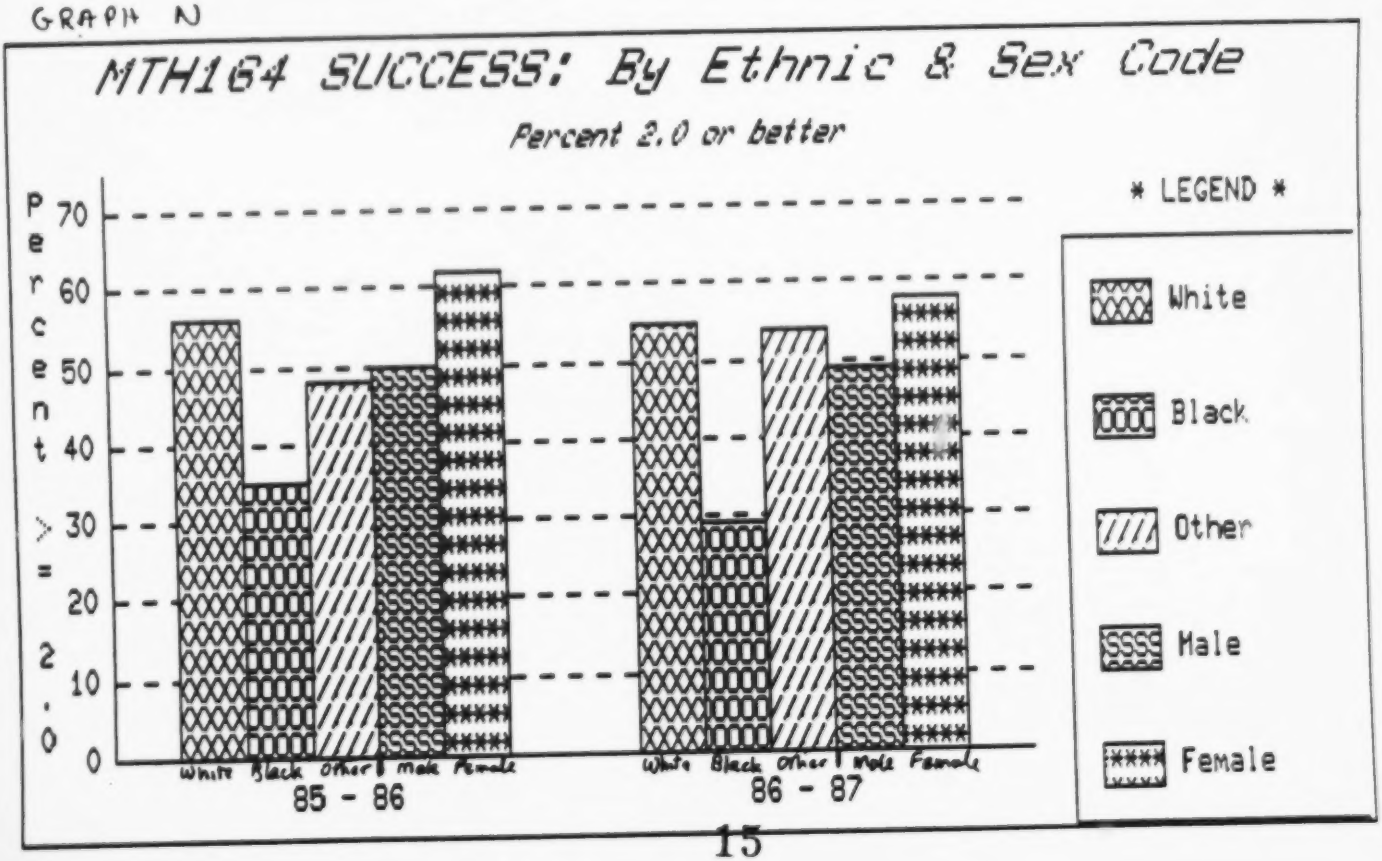
GRAPH L



GRAPH M



GRAPH N



I also wished to briefly comment on the networks and resources that seem to be available to professionals in developmental mathematics education. Certainly the most appropriate institution is AMATYC, which helps by offering conventions such as this, and by having various committees related to developmental math. As much as I appreciate these efforts by many people, I feel that AMATYC tends to focus more on the levels immediately above the developmental -- precalculus, calculus, basic computer science, etc. The other college mathematics group (MAA) focuses its efforts mostly at the higher course levels. NCTM is an institution dealing primarily with the K-12 levels, and occasionally has sessions at conferences for developmental math. In the case of both the MAA and NCTM, the efforts that are present are more appropriate for a "remedial" math program, rather than a "developmental" math program.

To me, then, it seems that the 3 main math education institutions, from a developmental mathematics educator viewpoint, leave much to be desired. There are groups whose attention is definitely on "developmental" education, such as NADE (National Association of Developmental Educators) and the Center for Developmental Education at Appalachian State. These institutions, however focus on the "developmental program" -- colleges which offer a developmental learning center including (possibly) content in reading, writing, and learning skills as well as developmental math. These efforts speak to the level of our developmental math program, but the context is not very close to ours. From all that I have read and heard, the vast majority of developmental math is offered much as ours -- as part of the math department; personally, I value this situation. However, I find it challenging to have the same professional interchange of ideas and results that seems to be present for the remainder of the 2 year college mathematics program.

It is probably clear to you that, as much as anything else, I am indicating my frustration; I have found it more difficult than seems necessary to benefit from the efforts of others in similar programs. Perhaps there are some things that can be done within the context of AMATYC that would help; if nothing else, a national directory of developmental math programs and faculty would be a great starting point.

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Junior Colleges JAN 29 1988